Hybrid Scanner Introduction Guide

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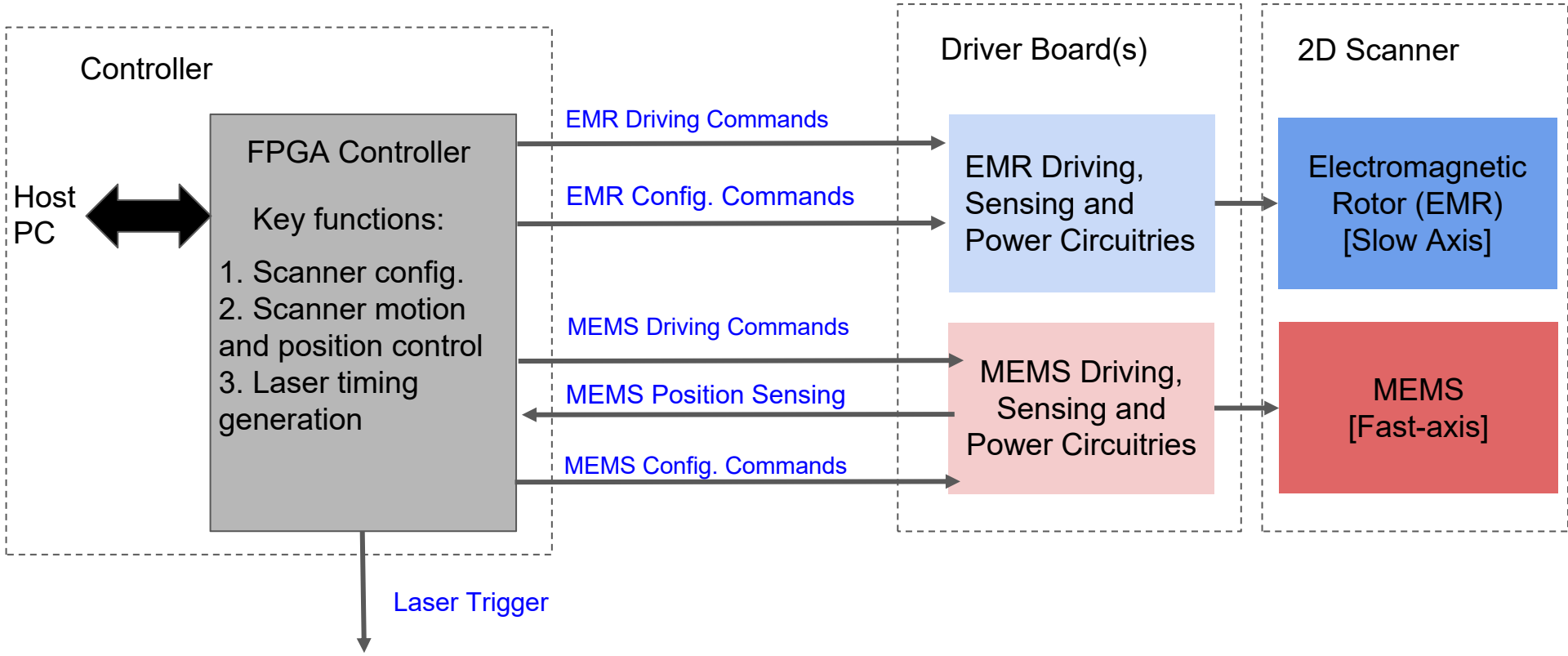
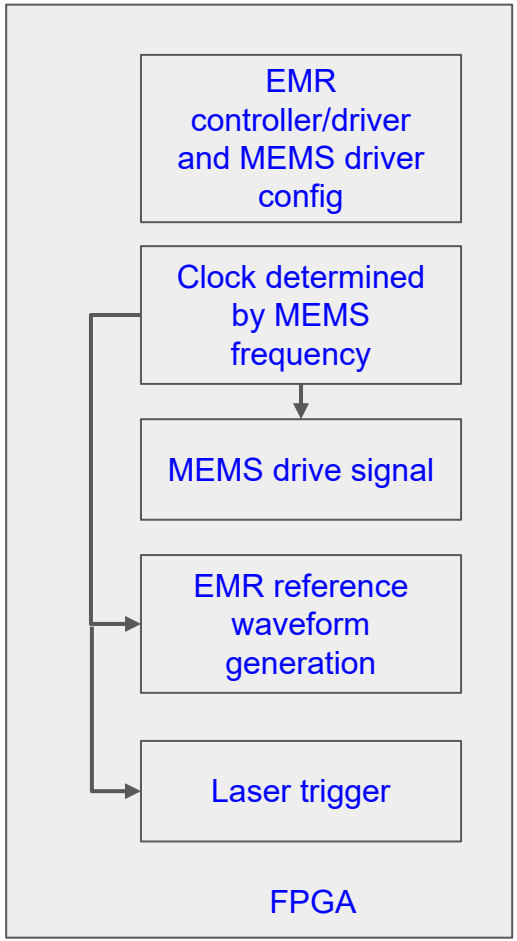
Overall Architecture

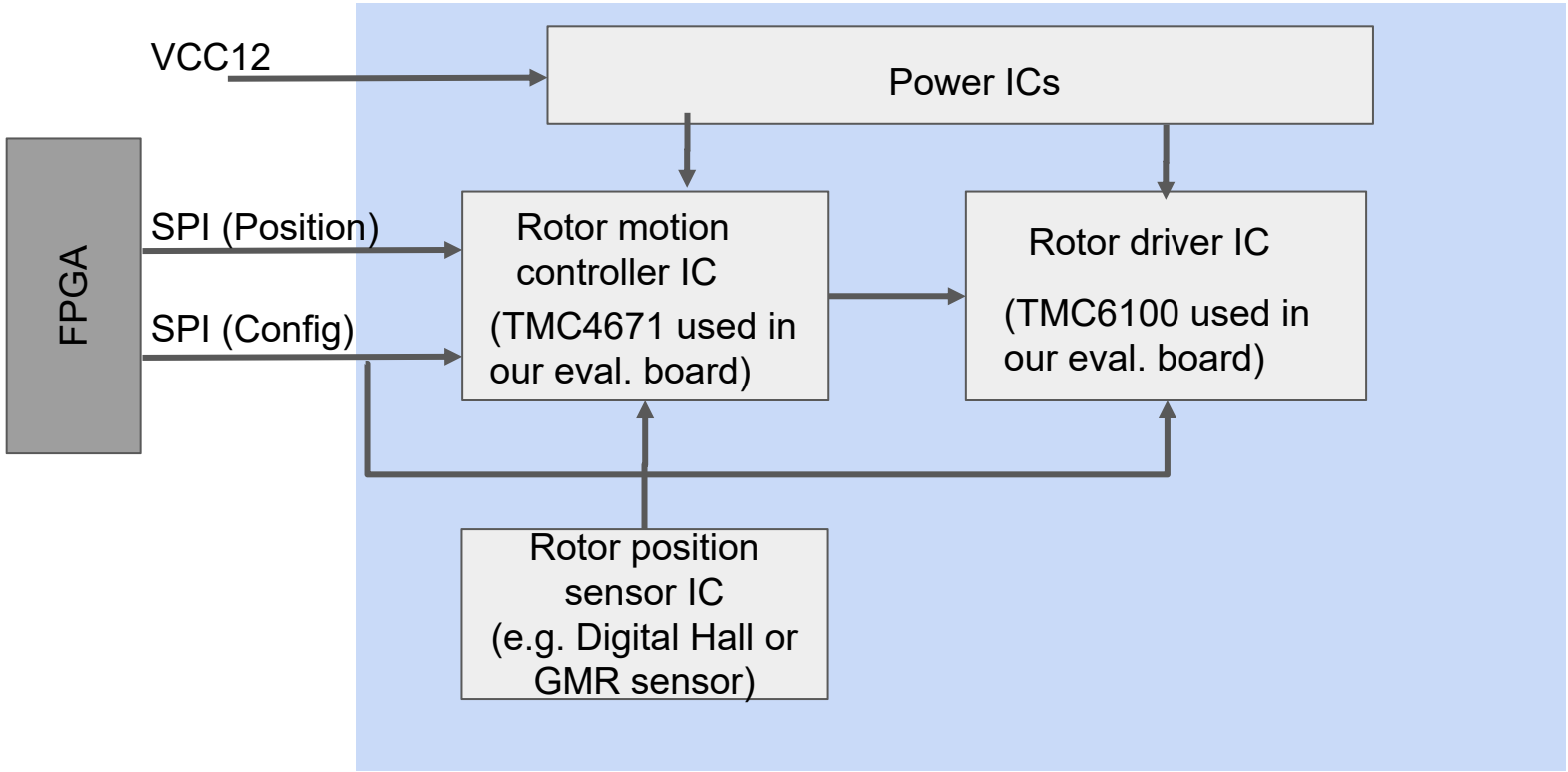


Working Principles

- Overall hybrid 2D scanner's reference clock is set by MEMS frequency f_mems
- FPGA write desired setting to the EMR controller, driver and MEMS driver to set the proper driving voltages (e.g. common-mode, amplitude for MEMS), position/speed PID parameters for the EMR controller and driver (e.g. max angle of the EMR)
- FPGA generates a MEMS driving signal that is in line with the MEMS resonance frequency to start the MEMS
- MEMS sensing circuit senses the position and phase of the MEMS mirror
- FPGA processes the MEMS position information to derive the position command for the EMR, such that the two axes can be synchronized
- FPGA processes the MEMS and EMR position information, and generates laser pulse trigger



Components in the EMR Driver Board



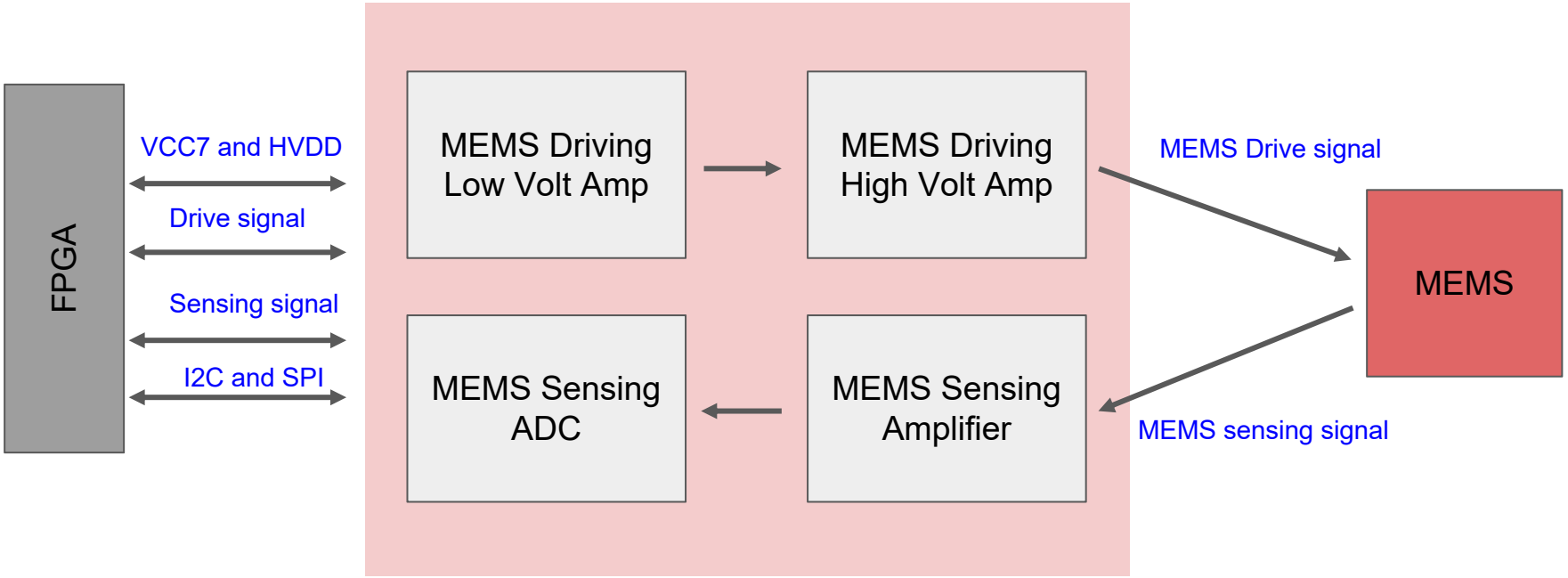
EMR Electrical Interfaces to FPGA

	Name	IO Type	Voltage Level (V)	Max data rate (MHz)	Functionality	Notes
1	4-wire SPI (EMR Position Command)	IN/OUT	3.3	10M	Continuously send EMR position command	Share MISO, MOSI, CLK
2	4-wire SPI (EMR Driver Config.)	IN/OUT	3.3	10M	Set EMR driver parameters, generally done only once	Share MISO, MOSI, CLK

Power Interfaces

	Name	IO Type	Voltage Level (V)	Functionality	Notes
1	VCC12	Power	12 (1.5A max)	Power supply for the controller and driver boards	
2	GND	Power	0		

MEMS Driver Board



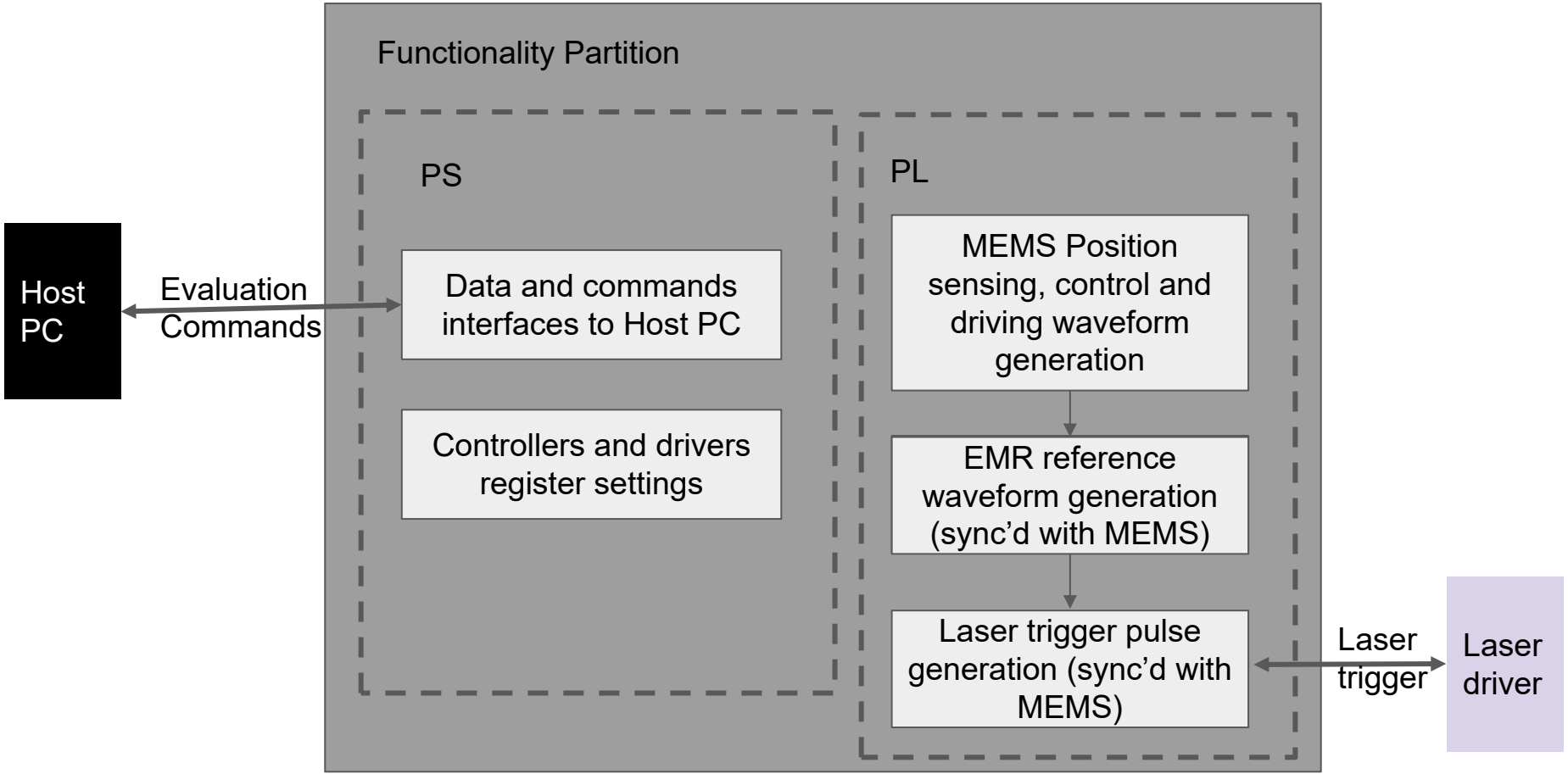
MEMS Electrical Interfaces to FPGA

	Name	IO Type	Voltage Level (V)	Max data rate (MHz)	Functionality	Notes
1	I2C	IN/OUT	3.3	10K	Board config.	Digital signal
2	TS	OUT	1.8	DC	Temperature sensor reading	Analog value
3	LO	IN	1.8	3M	Position sensing reference clock	Analog signal
4	DRV	IN	1.8	4K	MEMS driving signal	Analog signal
5	LO2	IN	1.8	3M	Position sensing reference clock 2	Analog signal
6	4-wire SPI	IN/OUT	1.8	10M	Position readout	Digital

Power Interfaces

	Name	IO Type	Voltage Level (V)	Functionality	Notes
1	VCC	IN	7	Circuit core voltage	
2	HVCC	IN	200	MEMS driving voltage	
3	GND	IN/OUT	0	Power	

FPGA Controller (Zynq-7000 FPGA in our eval. system)



Host PC Interface

	Name	IO Type	Functionality
1	Data and command	Ethernet	Data and command exchange
2	Debug	UART (Micro USB port)	Configuration and debug

Signal Interface

	Name	IO Type	Voltage (V)	Max data rate (KHz)	Functionality
1	Laser trigger	CMOS	1.8	128	Laser trigger

Evaluation Commands

- The steps to set up the host PC are provided in separate documentations
- We currently provide the following commands to evaluate our scanners

	Name	Functionality
1	get_freq	Get the current MEMS scanning frequency
2	get_angle	Get the current MEMS scanning angle
3	init_galvo	Start the vibration of the galvo
4	stop_galvo	Stop the vibration of the galvo

Please Let Us Know Your Needs

- All FPGA interfaces are customizable by request, e.g.
  - IO types
  - IO voltage levels
- Evaluation commands are also customizable by request, e.g.
  - Some lower level register access
  - More functionalities